

Figure 1 8x8 Phased Array Antenna

# Receiver

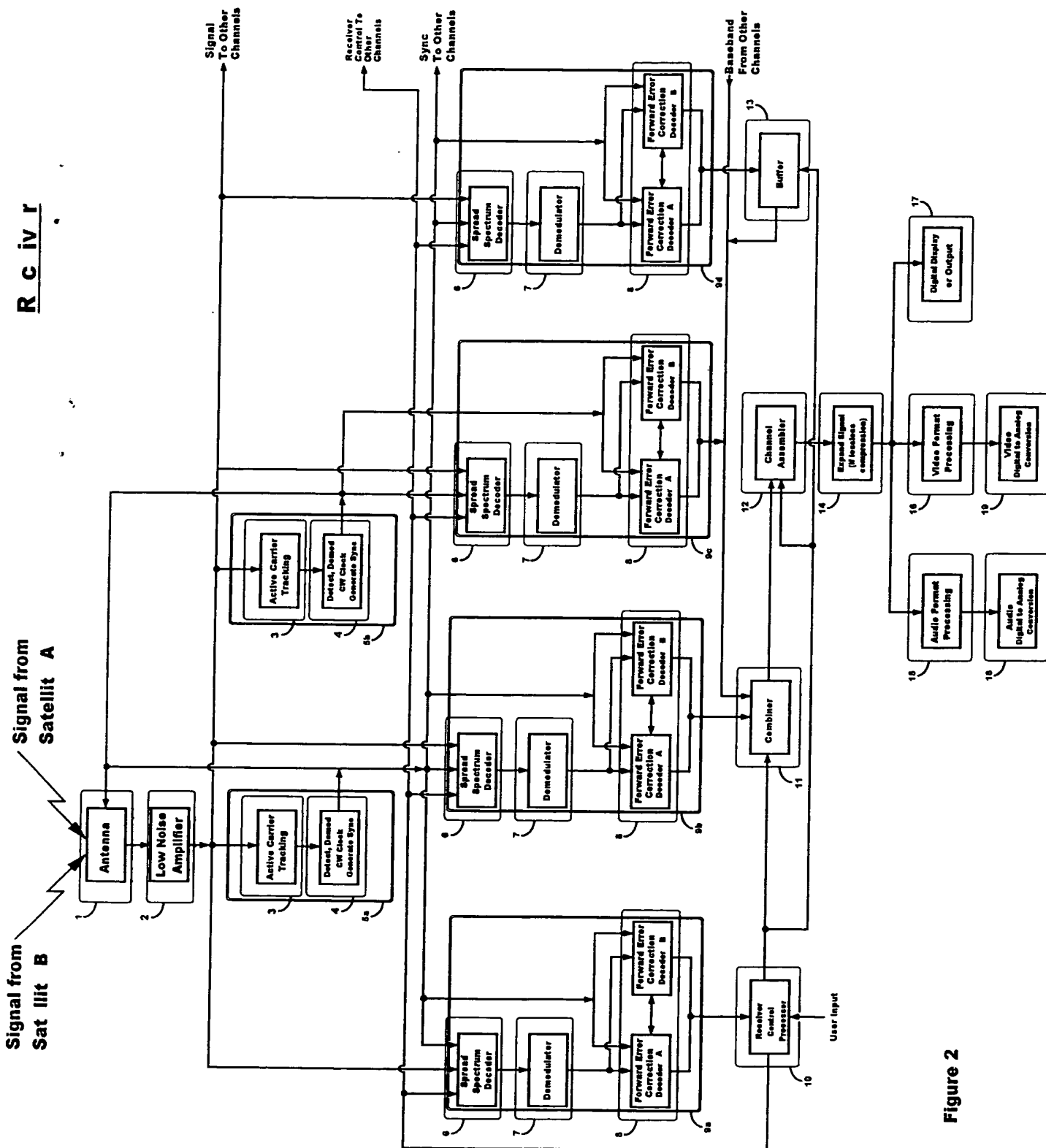
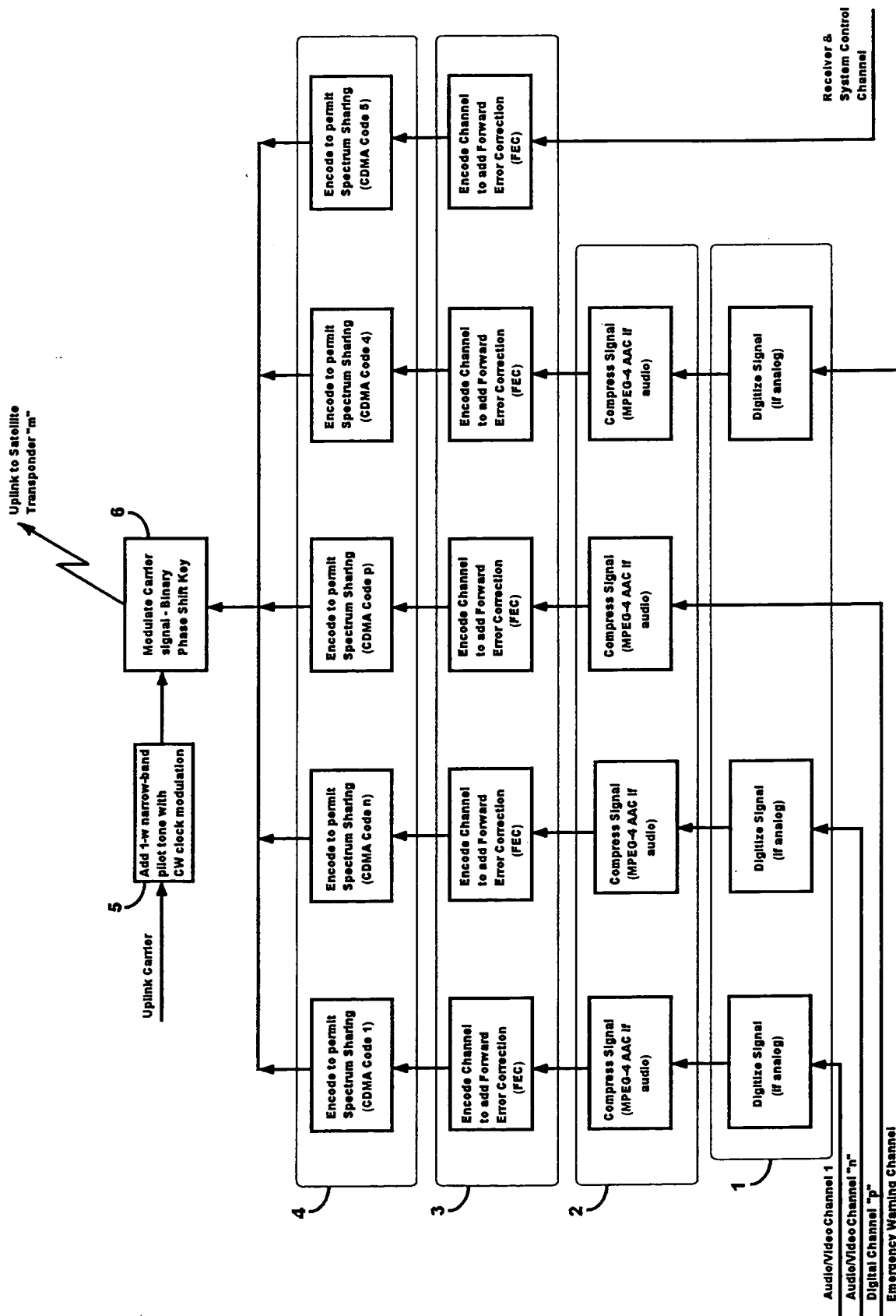


Figure 2

Uplink Process (Elements may not be physically collocated)

Figure 3



## Preferred Design for Audio Applications

Step	Where	Action	Signal Process
1	Audio Processor	Digitize Audio Source	Sampling to 22.05-kHz audio @ Nyquist rate (44.1-kHz rate)
2	Audio Processor		Quantization: 16 bits per sample (65,536 levels)
3	Audio Processor	Compress Audio	MP3-4 Advanced Audio coding (AAC) (incorporates Huffman coding, Unequal Error Protection (UEP)) 24-kbps per high quality (4.2 on scale of 5) music channel
4	Audio Processor	(Baseband)	Use adaptive transform Frequency Domain Coding, floating point to emphasize primary audio components > Blocked Packets
5	Audio Processor	Add Speech Channels	Narrowband Code Excited Linear Prediction (CELP) coding: 6 to 8-kbps per channel (3 to 4 channels)
6		Add Non-audio Digital Channels	Variable size channels (rates) carrying broadcast digital data
7		Add Receiver Control Channel	24-kbps channel allocated per transponder for control information
8	Uplink Processor	Channel coding	Forward Error Correction (FEC) ; Recursive, Systematic, Convolutional (RSC) Turbo Code, Rate 1/4, length 15, design for 10-5 BER, Parallel Concatenated Convolutional Codes (PCCC)
9	Uplink Processor		Use punctured convolutional coding to permit Equal Error Protection (EEP) & Unequal Error Protection (UEP)
10	Uplink Processor		Uplink block length dynamically adapted
11	Uplink Processor		Direct Sequence Spread Spectrum Code Division Multiple Access (DSSS CDMA) - Spread each channel to 36-MHz
12	Uplink Processor		Combine with other channels - Number of channels determined by Sat EIRP, User Antenna Size
13	Uplink Processor		Modulate Uplink Carrier - Binary Phase Shift Key (BPSK)
14	Uplink Processor		Add Pilot Tone (center freq)
15	Uplink Transmitter	Uplink	Transmit to Spacecraft
16	S/C Transponder	Receive, Turnaround	Spacecraft Transponder Turnaround
17	S/C Transponder	Retransmit	37 - 42 dBw EIRP
18	Receiver Antenna	Receive Signal	Receiver Antenna Receive pilot tone, phase antenna
19	Receiver Antenna	Detect, Synchronize Carrier Signal	Detect Signal Phase, Synchronize receiver clock, Active Carrier Tracking (Critical Step)
20	Receiver Antenna		Downconvert signal to 70 MHz IF
21	Receiver	Bit Synchronization	
22	Receiver	Decode Signal	Maximum a Posteriori algorithm (MAP) decoding
23	Receiver		Detect desired channel-specific CDMA code
24	Receiver		Use Backward Adaptive Bit Allocation
25	Receiver		Reconstruct compressed audio signal, Expand to uncompressed audio
26	Receiver		Digital to Analogue conversion
27	Receiver		Feed playback system
28	Receiver	Auxiliary Functions	Verify authorization to receive desired channel, Identify Intellectual Property Rights
29	Receiver	Auxiliary Functions	Strip and display ancillary channel information, Determine if Warning Channel should pre-empt

**Fig.4**